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THE PUSA PEDIGREE DAIRY HERD

IN

NORTH BIHAR

SECRETARIAT ... 21 OCT 1924 ... MADRAS GOVT.

BY

G. S. HENDERSON,

Offg. Director of Agriculture, Bihar and Orissa.

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PLATE I.—Cattle grazing on the leguminous crop *Guar*.

CHAPTER I.

In India the cow is at once the object of religious devotion and of the most inhuman cruelty. Cow keeping and cattle breeding generally, are involved in a mist of superstition and ignorance. While it is impossible to approach the subject in an entirely utilitarian attitude yet the results of modern investigation in dairy teachnique must be used. The religious point of view cannot be ignored as in the sight of an orthodox Hindu to kill a cow is a sacriligious act.

It is not the writer's intention to deal with the many varied breeds of cattle in India. These have undoubtedly been slowly evolved when and where economic conditions were favourable. When these economic conditions have altered some of these fine breeds are threatened with extinction. As against these breeds in special districts, over the great mass of the Indian plains, are found cattle of an exceedingly inferior description. They are also the result of economic circumstances. The food supply is only sufficient for a bare existence and the strong points of these cattle are their hardiness and their immunity to disease. To abruptly alter existing agricultural conditions without sufficient preliminary study is frequently a dangerous practice. So it is a matter for very careful consideration before so-called improvements are introduced under conditions such as these. Special attention must be given to the available food supplies, for example it is a bad policy to distribute heavy and probably unaclimatised bulls through the villages for use on small village cattle.

It certainly seems to be a case of "hasten slowly" in order to improve the general mass of cultivators' cattle throughout India. "You cannot have your cake and eat it" and if religious sentiment demands that a mob of under-fed animals (including uncastrated males of all descriptions) should remain untouched, preventing the substitution of better stock then there seems little to be done. However there remains sufficient scope for

the more favoured parts of India—work which is large enough to occupy all the means and labourers likely to be available.

The special breeds are being now generally fostered by the Local Governments in some cases when it is very late in the day, by pedigree herds, by herd books, and by cattle shows. The red cattle of Karachi have had little assistance though they are among the most useful dairy cattle of India. His Excellency Lord Willingdon while Governor of Bombay Presidency gave a good lead to private owners in this respect, in founding a select little herd of Karachi cattle and keeping accurate records. But general dairy work is very, very far behind what might be expected. The price of milk in large cities has risen to famine limits, four annas per lb. is a common price in Calcutta. This question of city milk supply is a very important branch of the cattle question in india.

While a considerable volume of correspondence appears in the daily press on the cattle question, it is generally obvious that the authors are not experts and have very confused ideas on the whole subject. On the other hand, experts with a foreign training are apt to ignore the Indian religious aspects. Accurate data on the subject have been published and those interested should study the following publication :—

(1) "Milk supply of Madras" by A. Carruth published by the Madras Department of Agriculture.

(2) Report to Calcutta Municipality by Col. Matson of the Military Dairy Department, on the milk supply of Calcutta.

(3) "Milk supply of Bombay" by Dr. Harold Mann who was in consultation with Mr. William Smith, Imperial Dairy Expert.

These are most valuable documents and give a clear and logical view of present conditions. The usual letter to the Editor in the Daily Press begins by denouncing cow-killing quite ignoring the fact that if many of the cows in India were killed there would probably be more and milk. From a purely utilitarian point of view, the a bad cow is no loss to any one.

Another important fact is that natural grazing in India is usually a delusion and a snare. When it is most wanted, it is not there. From January to May the so-called grazing is represented by dried up and sun-burnt plains on which the wretched cattle wander, trying to snatch a meagre mouthful in the arid fields. Also it is often lost sight of, even by those who ought to know better, that the old controversy about the dual purpose animal referred to beef and milk and not to draft and milk. It may be safely asserted that the best class of draft animals can only be produced from "milky" dams.

Another point to be remembered is that a demand from abroad for Indian cattle instead of being a drain on the country is more apt to be an encouragement for the breeders of the best class of cattle. If they get a good price for their stock, they are more likely to devote more attention to cattle breeding. This does not apply, however, to the milk cows of the Calcutta "gowalas", or to the buffaloes of Bombay. It pays the "gowalas" to collect good young stock in the Punjab and the United Provinces, and keep them only while in milk. The milking period is artificially extended over an abnormal time by what is known as the "Pukka process". The generative organs of the cows are so tampered with that while the flow of milk is extended, the cows are unable to breed thereafter. This process has certainly nothing to recommend it and it ought to be absolutely stamped out by the most rigorous means possible.

It has often been suggested that the formation of a Royal Agricultural Society would be of great advantage to India on the lines of the Royal Society of England. Conditions are rather different in India and while the Royal Society has done much useful work in England it is chiefly in co-ordinating the various breed societies. Such societies are wanting in India and it is spade work at the bottom that is most necessary. The Royal Society could well be introduced at a later stage of development.

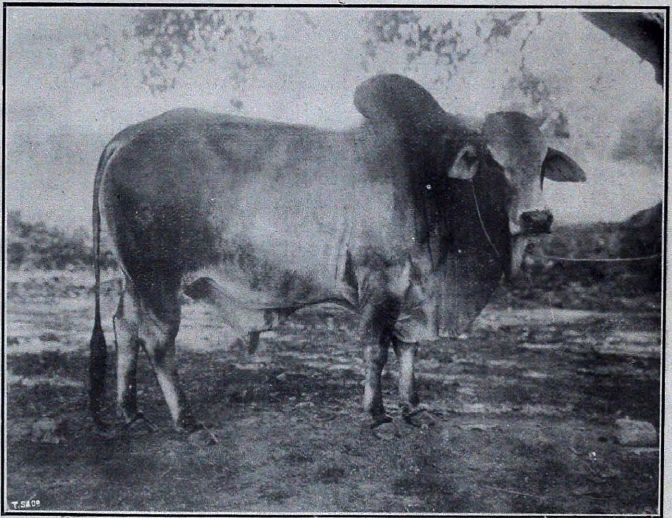

PLATE II.—Montgomery Bull.

CHAPTER II.

Pusa Pedigree Dairy Herd.

A brief account of the Pusa Dairy Herd will be of interest as showing what has been accomplished in the humid North-East of India with dairy cattle from the Punjab. This herd was started by Mr. Mollison with a number of good Saniwal (Montgomery) cattle bought in the Punjab. It was noticeable that the cows of the second generation went back in their milk yields considerably. The bull which was most used in the herd has not proved himself to be of a first class milk strain. This of course can only be found out after his heifers come in milk. In starting a herd the best policy when a pedigree animal is not obtainable, is to use as many bulls as possible, until certain results are obtainable through the milk yields of the heifers and then the best strains can be selected and fairly close in breeding practised till the type is definitely fixed.

In 1914 Mr. Milligan divided the herd up into families and treated each family as a separate herd, with the underlying object of obviating the necessity of the introduction of new blood. Practically no new blood has been introduced into the herd for the last 10 years. He also took out of the Montgomery herd those animals which gave less than 2,500 lbs. of milk in a lactation period of 10 months. These latter cows were not sold off but were bred to an imported pure Ayrshire bull and thus the cross-bred Ayrshire Montgomery herd was started. Since this time the selection work has been rigorously carried out and in the Montgomery herd no cows are retained which do not give more than 4,000 lbs. in 10 months. The cross-bred herd has given very good results. At the present date only the first cross animals have been long enough in milk to give data. Although all these cows are the progeny of very poor milking dams yet the first cross cow has invariably proved a most excellent milking animal. The problem to be solved, however, is to produce a type among these cross-bred animals which will

combine the immunity and hardiness of Indian cattle with the milking capacity of the Ayrshire strain. In the chapter on breeding more particulars are given on the subject. But none of the half-bred animals are being retained which do not give more than 6,000 lbs. of milk in the 10 months period. These results also are a striking confirmation of the very important principle, that milk follows the sire and not the dam. It is a vital importance to breeders to know that while a good milking cow can be obtained from a poor milking mother served by a bull from an approved milking strain, it is extremely unlikely that a good animal will result from breeding a bad bull to a good cow.

Other mixtures of Ayrshire blood, viz., three-quarters, one-quarter, etc., do not seem to be giving such satisfactory results, but the material is not yet sufficient to definitely pronounce on this point.

In the last few years the number of the animals in the herd has varied between 3 and 4 hundred. There is sufficient land at Pusa to grow all the grain and fodder required and nothing is bought in, except local oilcake which is used to supplement the grain rations. This gives the Pusa herd much greater practical importance than if the "feed" had to be largely purchased in the open market.

All the cross-bred calves and the majority of Montgomery calves are weaned at birth. This point is returned to, in the chapter on calf rearing. Among the advantages, it has been found that cows calve more frequently when the calves are weaned at birth. The figures are as follows :—

(1) Montgomery cows with weaned calf, 1 calf in 14 months.

(2) Montgomery cows unweaned calf, 1 calf in 18 months.

(3) Cross-bred cows with weaned calf, 1 calf in $12\frac{1}{2}$ months.

It can be readily seen how much more profitable this procedure is as the great expense of keeping a large percentage of dry cattle is reduced.

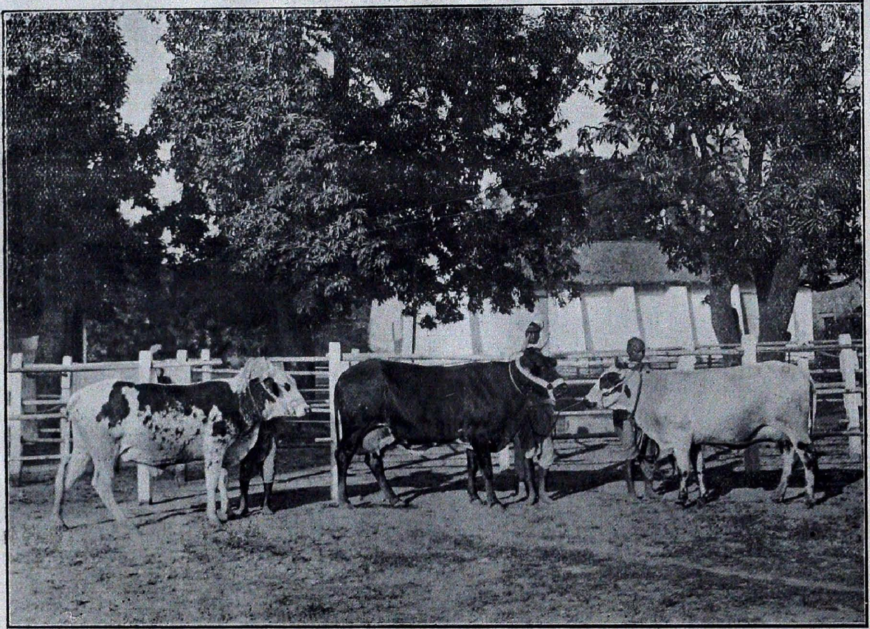

PLATE III.—Three cross-bred cows of the Pusa herd.

CHAPTER III.

Dairy Cattle and Management.

The types of cattle at Pusa can be well seen from the photographs appended. Constitution seems to be all important so a big, square, "roomy" body with short legs and somewhat inclined to coarseness is desirable. But square, fat "bullocky" hind quarters are not desirable as cows with the latter characteristic are generally bad breeders. The types are various among the Saniwal cattle at Pusa. Both various shaped, loose and fixed horns are found. The prepondering colours are a whole fawn or red. Greys are not popular.

The Ayrshire breed was selected for crossing purposes chiefly because good specimens can be obtained at a reasonable price. The Ayrshire cow is the tenant farmers cow. It is not like many of the other breeds, which are too often showyard freaks and the playthings of wealthy breeders. The home of the Ayrshire cow is on the bleak uplands of the South-West of Scotland where both man and beast have to be of a hardy nature to wrest a livelihood from the inclement country. The Ayrshire cow thrives when the more pampered breeds could not show a profit. In the bad farming days of the "eighties" disaster began to overtake the wheat growing farmers on the Essex clays. Their old rotation of wheat and beans could not be carried on in face of the competition with the colonial grown wheat. Large tracts were becoming derelict when the Ayrshire farmer with his cows, came down and laid this land down to grass, sending his milk to the London market. So land which was worthless became again productive and capable of paying a good rent, thanks to the adaptability of the Ayrshire cow and her owner.

A good stamp of young Ayrshire bull can be landed in India at about Rs. 2,500. As has already been stated the first cross with the Ayrshire bull and Montgomery cow invariably gives a first class milking animal. Further crosses however are very much more doubtful and there is

considerable danger in letting uncastrated cross bulls be distributed in the districts. When castrated they make good work bullocks and they are quick movers. The cross animals lose the hump.

At Pusa the heifers come into season about two years old. The first lactation cannot be accepted as a safe indication of the milking powers of the cow. Generally all female animals are judged on two complete lactations. After 10 calender months in milk they are dried off as soon as possible. The cows are milked at 11 O'clock in the morning and 11 O'clock in the night and while they are being milked the grain ration is fed. As soon as the milkings are completed the cows are put outside in the fields on green pulses or berseem. They are thus kept inside for as short a period as possible and provided there is plenty to eat the cold even in winter time, has no injurious effect. The dry and young stock are provided with ample food. It is a great mistake to put dry stock on inferior grazing and let them get into bad condition.

One gowala or milker tends from 8 to 10 cows and the milk is at once weighed on a spring balance and entered in the records. The records of two pure Montgomery cows and two cross-bred cows are appended at the end of this chapter.

Strictly speaking, these yields should be standardised to a common percentage of butter fat but the staff available is not sufficient to do all the testing required. The butter fat percentage in both lots of cows runs about 4 per cent.: some cows give as much as 7 per cent. The milk at Pusa is distributed directly to customers waiting at the building, so no handling of the milk is required. The surplus milk of the herd is now being marketed in neighbouring stations where there is a great demand springing up.

—	Alibi Cross-bred cow.	Daisy Cross-bred cow.	Jogni Montgomery cow.	Imani Montgomery cow.
Date of 1st calf ...	22nd October 1917.	1st December 1917.	14th August 1914	19th September 1914.
lb. milk. ...	7,271	6,763	4,100	* 4,465
Date of 2nd calf ...	30th December 1918.	27th February 1919.	19th October 1915.	28th December 1915.
lb. milk. ...	7,989	6,801	4,667	6,200
Date of 3rd calf ...	26th March 1920	24th March 1920	26th March 1917	8th December 1917.
lb. milk. ...	9,722	*5,499	5,464	5,654
Date of 4th calf ...	18th March 1921	7th March 1921	14th March 1919	12th October 1919.
lb. milk. ...	11,839	8,429	6,457	*3,782
Date of 5th calf ...	17th June 1922	21st May 1922	28th October 1920.	27th August 1920.
lb. milk. ...	12,028	8,252	6,054	4,291

* Denotes Foot and Mouth disease.

PLATE IV.

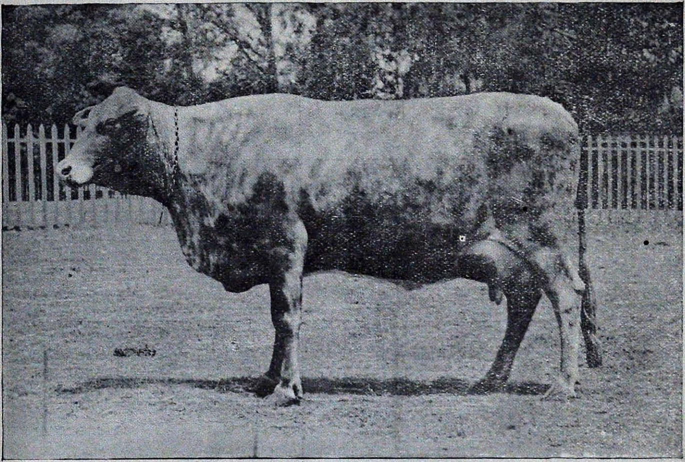

Fig. 1. Cross-bred Cow "Jill" (Bangalore).

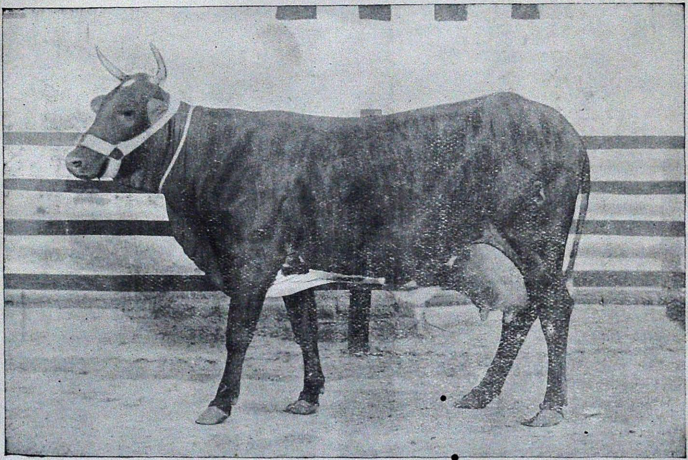

Fig. 2. Cross Ayrshire-Montgomery Cow "Alibi" (Pusa).

CHAPTER IV.

Breeding Herd.

In the Montgomery herd the problem chiefly involved is that of selection for milk yields, uniformity of appearance is a secondary matter. Other points to be looked to, are regularity of milk flow during the lactation and regularity in coming in heat. Some strains of cows have got the very bad trait of giving an ample flow of milk at the beginning of the lactation and then very rapidly drying off. These cows should be cleared out as they will do no good. It has been observed too that some families of cows milk well but are very difficult to get in calf. They may remain dry for two or three years at a time.

In the cross-bred herd the breeding problems are very much more complex. Besides selection, other factors have to be considered such as the amount of foreign blood required and the general type of animal which would be of most value for the country. So far as work has proceeded the most promising results seem to follow on breeding among the half-bred animals, that is to say, a half-bred cow is bred to a half-bred bull and the progeny will thus be double cross. Work is being chiefly concentrated on these animals.

The Military Dairy Farms have experimented with Fresian crosses and also with Dairy Shorthorns. Jersey crosses have also been experimented with spasmodically in India. Good results have been obtained in nearly all cases with the first cross when good animals have been brought from Great Britain. Stock from Australia does not seem to have been so satisfactory so far as the data are available. It may be that there is a want of vitality in the Australian stock. This only bears out what has been found in other countries such as South America where pedigree breeders have to renew their breeding stock periodically from Great Britain.

The prepotency of the sire for milk purposes has already been referred to, so a really good bull is absolutely essential

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in a dairy herd. It is possible to grade up a herd of somewhat indifferent cows if only the owner will go to the expense of procuring a bull of a milking strain. This valuable fact makes the future of dairying a much more encouraging proposition.

The liability from loss by disease has got to be reckoned with in all dairy schemes in India. Rinderpest is by far the most destructive scourage in India. The prevalence of this disease has been put forward as a reason against the use of foreign blood. It has been proved that the method of simultaneous inoculation which is advocated by the Veterinary Department gives a practical immunity from this disease. The records of the Military Dairy Farms confirm this view based on more than 10 years experience.

Experience up-to-date seems to point out that a whole-coloured black-skin animal, short in the leg and broad barelled will be the type required. Several attacks of Foot and Mouth disease seem to indicate that this type of cross-bred animal is the hardiest.

PLATE V.

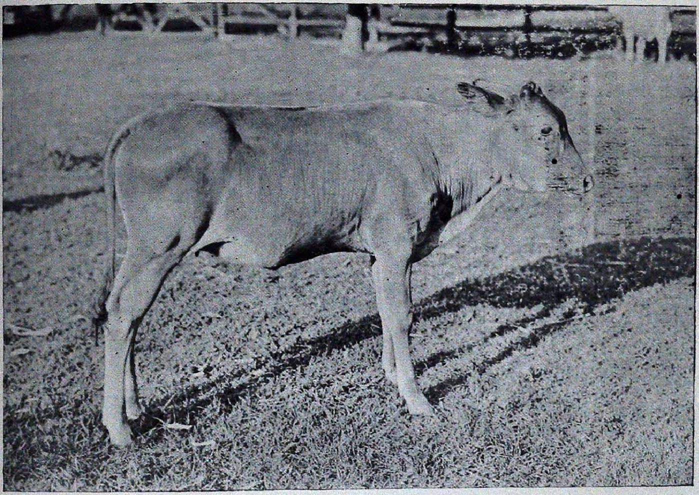

Fig. 1.—Double cross cow-calf of Kitty No. 10, five months old.

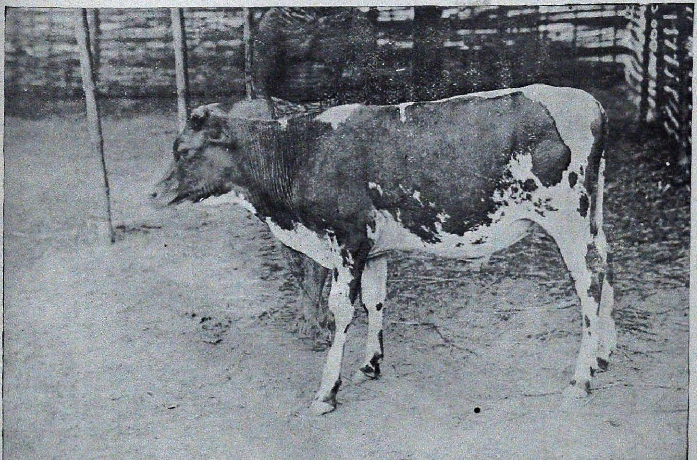

Fig. 2.—Double cross bull-calf of Dollie No. 20, five months old.

PLATE VI.

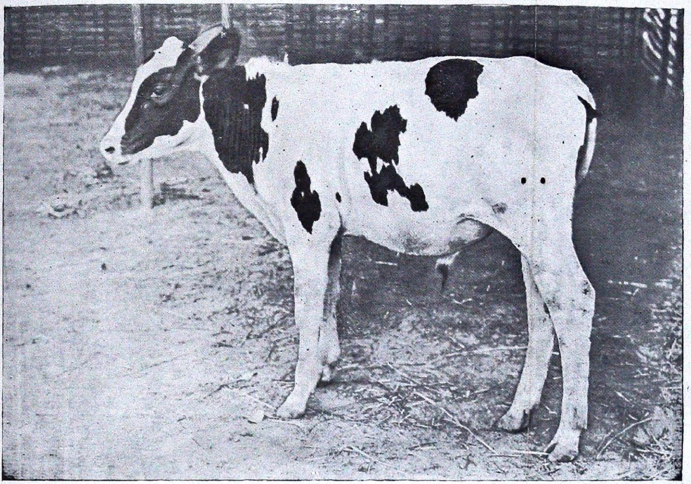

Fig. 1.—Three quarter-bred bull-calf of Bidy No. 2, five months old.

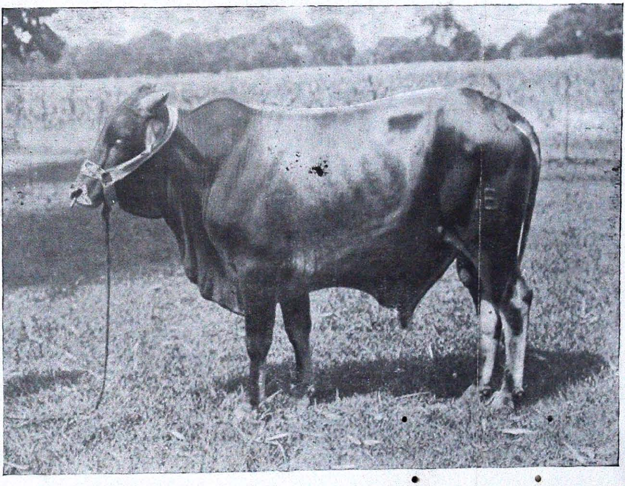

Fig. 2.—Half-bred Ayrshire-Montgomery bull sold to the Hyderabad State.

PLATE VII.—A bunch ot three-quarter ant couble cross calves.

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CHAPTER V.

Calf Rearing.

No particular difficulty has been found in successfully bringing up the Montgomery calves but it is necessary to give them ample milk. The calf very soon learns to take the milk out of the pail. The milk should be warmed and at first, fed several times a day. The following table shows the treatment adopted at Pusa.

Scale of Calf Feeding.

Age.	Whole milk per day.	Separated milk per day.	Grain in lb. per day.
1 Week ...	10 lbs. ...	...	...
2 Weeks ...	10 „ ...	...	...
3 „ ...	10 „ ...	...	...
4 „ ...	10 „ ...	...	...
5 „ ...	$10\frac{1}{2}$ „ ...	...	$\frac{1}{2}$ lb.
6 „ ...	$10\frac{1}{2}$ „ ...	...	$\frac{1}{2}$ „
7 „ ...	11 „ ...	...	$\frac{1}{2}$ „
8 „ ...	11 „ ...	...	$\frac{1}{2}$ „
9 „ ...	12 „ ...	...	1 „
10 „ ...	12 „ ...	...	1 „
11 „ ...	12 „ ...	...	1 „
12 „ ...	12 „ ...	...	1 „
13 „ ...	6 „ ...	6 lbs. ...	$1\frac{1}{2}$ lbs.
14 „ ...	6 „ ...	6 „ ...	$1\frac{1}{2}$ „
15 „ ...	4 „ ...	6 „ ...	$1\frac{1}{2}$ „
16 „ ...	4 „ ...	6 „ ...	$1\frac{1}{2}$ „
17 „ ...	2 „ ...	8 „ ...	2 „
18 „ ...	2 „ ...	8 „ ...	2 „
19 „ ...	......	8 „ ...	$2\frac{1}{2}$ „
20 „ ...	......	4 „ ...	3 „

In the past year out of a total of 30 Montgomery calves born there were 7 deaths and out of 64 Cross-bred calves born there were 7 deaths. This is quite satisfactory and shows there are no practical difficulties if the treatment is correct. The young calves are rather apt to suffer from "Scour" or violent diarrhœa. Their surroundings should be kept absolutely hygenic with good dry floors in the calf sheds. They should be let out as much as possible in a field with short grass. It will be seen from the above table that the milk ration is entirely dispensed with after 5 months. The advantages of pail feeding the calves are numerous. It has already been pointed out that the cow comes in season more frequently. From a milk point of view, the milk is much more under control, the housing is much simpler, and much more effective supervision can be exercised.

The calves should on no account be confined in dark dirty sheds with damp rotting litter. Plenty of air is required and if well fed they will not suffer from the cold. It should be noted that the calf should be removed at birth and this must be commenced with the heifer's first calf.

PLATE VIII.—Velvet Beans for Green-Manuring.

CHAPTER VI.

Cultivation and grazing.

Mr. Hutchinson, the Imperial Bacteriologist has struck a timely note of warning in his address to the Indian Science Congress at the meeting held in Bombay in 1917. He pointed out the danger of upsetting the delicate equilibrium which exists in the Indian raiyat's cultivation between his crop yields and the available fertility of his land. The principle also applied probably, to a large extent, to the introduction of modern implements. For dairy work, however, this does not apply. It is necessary to produce fodder crops and they must be produced by direct cultivation. It is hardly practicable to base a dairy scheme on fodder produced by tenants. It is absolutely essential to produce the fodder near the dairy herd. Fodder is a bulky article and will not bear transport. It is impossible to run a dairy scheme profitably if the fodder has to be bought in the open market. Now it is a very different matter indeed to run a block of land by means of tenants than to cultivate the same area by direct cultivation. The fact is very seldom appreciated. It is probably one of the greatest difficulties in the way of extension of dairy work in India. Any considerable area of direct cultivation calls for expert supervision, suitable rotations and the provision of modern machinery and implements. It is impossible to lay down general lines of guidance for all parts of India, each district would have to be settled according to its individual circumstances. The plan of the cultivation at Pusa is quite useful as far as it goes but would have to be modified very considerably in most cases. A short description will give the general principles underlying the plan of operation.

The main portion of the arable land consisting of some 413 acres is under the following rotation.

—	1st year.	2nd year.	3rd year.
Monsoon crop (Kharif) ...	Maize for silage and fodder manured with 10 tons Farm Yard Manure or Oilcake at 10 maunds per acre.	Maize for corn.	Pulse or green crop for soiling.
Winter crop (Rabi) ...	Oats ...	Rahar (Cajanus Indicus).	Oats with an application of 1 maund super-phosphate per acre.

This rotation entails much work at two periods of the year but the heavy work is done by means of a set of Fowlers Steam ploughing tackle and many of the subsidiary operations are carried out by tractors. There are also some 35 pairs of work bullocks chiefly used for transport purposes. The produce from the above area for the last 11 years is given below. It will be seen that the fertility of the land seems not to have diminished under the very intensive cultivation pursued.

Total return of grain and green fodder from 13 fields at Pusa for the last 11 years

—	Oats and other cereals in maunds.	Maize grain in maunds.	Arhar, paddi and other grain in maunds.	Total grain in maunds.	Green fodder, maize, oats and peas in maunds.
	Mds.	Mds.	Mds.	Mds.	Mds.
1912-13 ...	2,210	522	894	3,626	16,301
1913-14 ...	1,997	200	1,100	3,297	11,313
1914-15 ...	1,749	534	704	2,978	14,427
1915-16 ...	2,669	884	701	4,254	36,903
1916-17 ...	2,897	670	932	4,499	31 971
1917-18 ...	2,376	1,276	1,010	4,662	30,893
1918-19 ...	3,386	559	1,037	4,982	30,735
1919-20 ...	2,479	1,064	719	4,262	31,624
1920-21 ...	2,542	766	1,073	4,381	33,359
1921-22 ...	3,754	1,267	1,132	6,153	34,492
1922-23 ...	3,752	496	941	5,189	23,021

NOTES :—(1) 13 Fields total 413 acres.
(2) Minor crop as sugarcane and indigo are omitted.
(3) Straw in cereal crops is about double the weight of grain.
(4) 27 maunds are equal to one ton.

This 400 acre area is not irrigated but to bridge the gap from January to May some 100 acres of low lying and formerly waste land have been levelled and put under irrigation. On this is grown berseem in the cold weather followed by maize in the hot weather. During the monsoon the land is flooded. This reclaimed land gives a most valuable succession of green fodder. The cattle are tethered on the berseem and they follow on by grazing on the early maize. They are kept on this and on the oat stubble until the break of the monsoon, thereafter the pulse crop area is available for their grazing and on this and on the maize stubble they are kept till the berseem is again ready. The actual feeding will be treated in a separate chapter. Silage is made from the maize cut green and this with the oat straw is the main source of fodder which they get inside in addition to the outside grazing. Particulars of the grain and fodder supplied to the herd from June 1920 to June 1921 is as follows.

Statement showing quantities of all farm produce and of food purchased fed to the Dairy herd and Farm and Estate cattle from 1st July 1922 to 30th June 1923.

Particulars.	Breeding herd.	Farm work cattle.	Estate cattle.	Grand Total.	Division of grand total.	
	Quantity.	Quantity.	Quantity.	Quantity.	Farm produce.	Purchased quantity.
1	2	3	4	5	6	7
GRAINS.	Mds.	Mds.	Mds.	Mds.	Mds.	Mds.
1. Oats grain	2,344	933	306	3,583	3,583	...
2. Pulses crushed ...	1,027	11	...	1,038	1,038	...
3. Maize grain ...	509	158	9	676	676	...
4. Barley	122	49	...	171	171	...
5. Miscellaneous grains...	2	92	...	94	92	2
Total ...	4,004	1,243	315	5,562	5,560*	2
6. Oil cake	653	201	...	854	...	854
7. Salt	123	20	...	143	...	143
Total ...	776	221	...	997	...	997
DRY FODDER.						
8. Oats and wheat straw...	4,748	1,915	1,085	7,748	7,748	...
9. Arhar and peas bhusa...	...	376	316	692	692	...
10. Dry maize chopped ...	...	511	233	744	744	...
Total ...	4,748	2,802	1,634	9,184	9,184*	...
GREEN FODDER AND SILAGE.						
11. Green oats and peas ...	1,662	2,257	887	4,806	4,806	...
12. Green maize and Guar	6,016	1,905	804	8,725	8,725	...
13. Green pulses ...	1,463	1,427	1,124	4,014	4,014	...
14. Guinea grass ...	...	41	100	141	141	...
15. Sugarcane	...	1,869	836	2,705	2,705	...
16. Green Berseem ...	634	845	285	1,794	1,794	...
17. Green Lucern ...	...	113	...	113	113	...
18. Turnips with leaves ...	213	...	...	213	213	...
19. Silage	8,385	346	158	8,889	8,889	...
Total ...	18,403	8,803	4,194	31,400	31,400*	...

* This includes outturn from 13 fields *plus* total experimental areas.

Average number of animals :—

1. Breeding herd 293
2. Farm bullocks 71
3. Estate bullocks 36

The cattle are thus not dependant on natural grazing. Cultivated crops are grown instead. There are some exercise fields round the building which are laid down to "Doob" grass of about 100 acres in area. These are very useful and add to the amenities of the estate. The fields can be ploughed up occasionally and a crop taken off them as they receive a considerable amount of manure. It is easy to get them laid down to "Doob" grass again as this grass grows naturally and luxuriantly during the monsoon. It is a surface feeder and is soon choked out by deeper rooted grasses.

What may be described as "ranching" is a very unsuitable system for dairying in India, that is to say, the keeping of cattle on a large grazing area. The proper cultivation of suitable fodder crops is the only method of running a dairy herd properly.

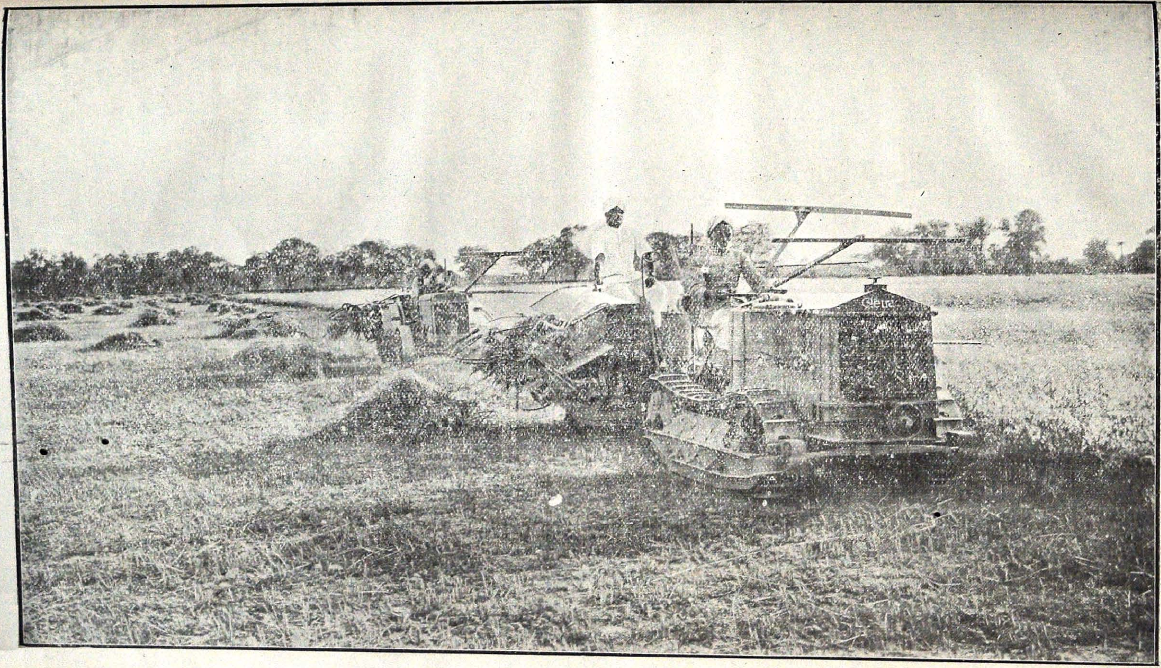

PLATE IX.—The "Self-binders," working in a light crop of Oats.

CHAPTER VII.

Fodder Crops and Silage.

From the rotation practised at Pusa it will be seen that maize, oats and some pulse crops are the chief items of cultivation. During the hot weather one-third of the area is under maize for grain, another third is under maize cut green for silage and the remainder is cultivated with pulses such as guar (Cluster Beans), cow-peas, velvet beans, etc. The following results have been obtained with quantitative experiments on the yields of common pulses.

Statement showing average outturn of 5 years of Kharif fodder pulses.

Kharif Pulses.	Average of 5 years of green fodder per acre in pounds.
1	2
(1) Meth (Phaseolus Acontifolius)	15,779
(2) Velvet Beans	12,410
(3) Cow Peas (Vigna Catiang)	12,257
(4) Cluster beans (Cyamopsis Psoraloides) ...	10,625
(5) Urid (Phaseolus Radiatus)	9,999
(6) Soy beans (Glycine Hispida)	7,836
(7) Florida Beggar Weed...	4,174
(8) Val (Dolichos lab lab)	3,955

All crops at Pusa are drilled and intercultivated by bullock implements thus reducing manual labour to a minimum. The irrigated area is sown with berseem or Egyptian clover (Trifolium Alexandrium) and this is grazed by the cattle each four or five weeks until the early maize is sown about the beginning of March.

Full details regarding the cultivation of berseem are given in Pusa bulletin No. 66 of 1916. There are a number of other crops which in other circumstances could replace

the maize in the rotation. Jowari (Andropogan Sorghum) will give a larger bulk of green fodder, but the silage is not nearly so good as the maize silage. Other more special crops are bamboo (Dendrocalamus Strictus) some varieties of sugarcane, sunflower, "Gonglu" or Punjab turnip and where irrigation is available say the drainage from the cattle building, lucerne, guinea grass, paspalum and Rhodes grass are all useful. Field peas and green oats in the cold weather make a very useful mixture for feeding green.

When maize grows really well there is nothing to approach it for a dairy fodder crop. At Pusa the green maize is cut in September chopped up by a silage cutter and blown into a silo pit. The pits are large enough to hold between three and four thousand maunds of green fodder and when they are full a plaster of mud is put on the top and the pit opens up in splendid condition. One hundred lbs. of green fodder gives an average of 66 lbs. of silage as weighed when fed to cattle. The other fodder stand by is the oat straw and it can be fed "long" that is to say as it comes direct from the threshing machine. The ideal method would be to feed the straw as it comes from the threshing machine on to the platform of the silage cutter and let it be cut and blown into the "bhusa" shed. It would then pack much better.

The American made silage cutters such as those produced by the International Harvesting Company of United States of America, are very efficient and well designed. Plenty of spares should be provided as the pinions are apt to strip. So far as the writer is aware only one British manufacturer produces a silage cutter. The old fashioned chaff cutter is generally made, the out-put of which is very small compared to a good sized American silage cutter which can deal with 10 tons of green fodder per hour.

It is beyond the scope of this work to give a description of the machinery and implements in every day use at Pusa. Careful data has been collected and this is available for public information.

The threshing is done by a standard 4′—6″ drum threshing machine provided with a feeding attachment, so that the sheaves can be fed from the ground level.

Work has been started with self-binding reaping machines but the price of binding twine at present makes the work too expensive.

The rates of sowing per acre are :—

Oats	32-40 seers drilled.
Maize for silage	8 seers.
Maize for grain	5-6 seers.
Pulses	12 seers.
Berseem	12-15 seers.

CHAPTER VIII.

FEEDING.

The cows in milk get 5 lbs. of grain per head per day if they are giving up to 10 lbs. of milk per diem. They get ½ lb. of grain extra for each pound of milk produced over 10 lbs., keeping the maximum up to 12 lbs. The young stock get up to 3 lbs. a head and the in-calf cows the same. The bulls get up to 5 lbs. per head per day. This grain ration consists of the grains grown on the farm, ground up and moistened with the addition of a little crushed oilcake. The grains are oats, maize, pigeon pea and small quantities of gram and other pulses. The oilcake is bought fresh from the village oil presser and is generally mustard or rape cake.

The calf feeding has already been dealt with. The cattle are out as much as possible grazing on fodder crops or stubble and in addition they get fed inside the sheds with an average of 20 lbs. of green fodder and 10 lbs. of dry fodder per head per day. This consists of maize, oat straw, silage, green oats, and field peas according to the season.

Wherever is the location of a dairy herd an area of irrigated land is of the very greatest assistance for the production of fodder in the hot weather.

The above quantities of grain and fodder are only general and individual animals require more or less according to circumstances.

CHAPTER IX.

Records.

Proper records are a "*sine qua non*". A selection from the records kept at Pusa can be had on application. Special notice might be taken of the Herd Book. Each animal has a leaf for itself and the leaves are interchangeable. When an animal is removed from the dairy herd its leaf is removed from the Herd Book and filed. Photographs of each animal are also very useful.

It has already been noted that the milk yields of cows are only recorded for 10 calendar months, thereafter the milk is not entered into the records.

All animals are branded and are given a serial number. It should be noticed that the daily yields at different periods of the lactation show great variation. The usual method of describing a cow in India as a "8 seer cow" for example means little or nothing.

CHAPTER X.

Buildings and Equipment.

The farm buildings at Pusa have not been specially designed for dairying. They are somewhat inconveniently arranged. Pusa was formerly a Remount Depôt and the old mule lines have been utilised for the dairy herd.

The cow lines consist of a building 300 yards long by 12 feet inside measurement. There are no travises and the cattle are tied at 3 feet apart to the pukka manger. Courtyards and calf sheds are provided on one side. Water is laid on from a small reservoir and well. The dry cattle and young stock lines are similar but are divided into loose boxes by low transverse walls. Numerous open doors and windows are provided so that there is no interruption to a through draft and ample ventilation. The courtyards are very useful for handling the stock. A pukka manger is built on both sides of the loose boxes. Calving sheds, a sick shed, bull sheds and straw sheds complete the buildings. White ants are not destructive and so timber can be used for the roofing.

The main farm buildings, where the work bullock lines are situated along with the grain stores and food preparing machinery are at a considerable distance. This arrangement is a very bad one but the whole establishment has been added to, bit by bit as means were available and the arrangement at Pusa cannot be cited as a model one. At harvest time the threshing is done beside each bhusa shed and similarly at silo making the silo pits are filled in rotation. The pits are placed two beside the dairy cattle, two beside the dry and young stock lines and two beside the work bullock lines. The equipment at the main farm building consists of a twenty horse power stationary oil engine which drives the main shafting, which drives the grinding machinery, etc. The ploughing engines and tractors are also used for pulley work as required. A workshop suitable for dealing with running repairs is established.

While it would be possible to design a much more satisfactory and economic set of buildings and general equipment still it is quite possible to obtain very useful practical data from the existing system.

It is a great advantage that the farm is comparatively level and that the fields are large. The difficulties which would confront irrigation cultivation have not got to be contended with and the Pusa soil is of such a light and friable nature that good cultivation is both easy and profitable.

PLATE X.—Cattle Auction Sale.

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CHAPTER XII.

CONCLUSION.

It can be gathered from the fore-going that the dairy work at Pusa has advanced a considerable distance but it has still a long way to go and the means provided are in no sense extravagant. The drawback with such work in India is the difficulty of ensuring continuity of policy. It is of little or no value to get breeding or dairying work started on sound lines only to have the whole policy altered in a few years time. The old breeders in Great Britain who did so much to improve the various breeds of cattle had a life time for the work, but in India the man in-charge generally has only a very few years. New brooms sweep clean and very apt to sweep out of existence altogether valuable work still in the first stages.

The Pusa auction sales show that there exists a demand in India for well bred stock and given a suitable site combined with efficient management, there seems no reason why dairying should not show a handsome profit. It is probable that particularly good results could be obtained on irrigation canal areas when combined with cotton growing.

The great difficulties likely to be encountered are :—

1. Disease.
2. Difficulty in acquiring suitable site, as land in India is frequently held by its owners for reasons without any reference to its monetary value.
3. Scarcity of practical trained Dairy and Farm Managers.

It must also be remembered that if the milk is going to be handled in any shape except for immediate consumption by customers an elaborate creamery outfit will be entailed, for which special experience and large capital are essential.

Any mention of Pusa Farm and Herd is incomplete without a word about the staff. Khan Sahib Muhammad Ikramuddin, the head of the executive staff, retired on 15th March 1923 after long and faithful service. It is largely owing to his hard work and business ability that the Farm and Herd have been brought to their present pitch. He is well backed by Messrs. Arjan Singh, Joseph and Jamaluddin.

B. & O. G. P. (Agri.) No. 13—600—17-9-1924—J. C. B.

தமிழ்நாடு ஆவணக்காப்பக நூலகம்,
எழும்பூர், சென்னை-600 008.

தவணைத்தாள்.

சே. எண் : 126748   ப. எண் : KZ31:17.2 N24

வழங்கிய நாள். (1)	திரும்பிய நாள். (2)	வழங்கிய நாள். (1)	திரும்பிய நாள். (2)

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